

TECHNOLOGY DEVELOPMENT THROUGH INDUSTRIAL PARTNERSHIPS

INTRODUCTION

Office of Science and Technology

The Department of Energy's (DOE) Environmental Management (EM) Office of Science and Technology (OST) manages an aggressive national program for applied research, development, demonstration, testing, and evaluation (RDDT&E). This program develops high-payoff technologies to clean up the inventory of DOE nuclear component manufacturing sites and to manage DOE-generated waste faster, safer, and cheaper than currently available environmental cleanup technologies. The primary goal is to protect human health and prevent further contamination.

The RDDT&E sponsored by OST is designed to make new, innovative, and more cost effective technologies available for transfer to DOE environmental restoration and waste management end-users. EM has divided its technology development program into Focus Areas and Crosscutting Technologies, which represent its highest priorities.

The Focus Areas are:

- Mixed Waste
- High Level Waste Tank Remediation
- Subsurface Contaminants
- Decontamination and Decommissioning

The Crosscutting Areas are:

- Characterization, Monitoring, an Sensor Technologies (CMST)
- Efficient Separations and Processing (ESP)
- Robotics

One of OST's strategies is to ensure that private industry, other Federal agencies, universities, and DOE National Laboratories are major participants in developing and deploying new and emerging technologies. This is accomplished through substantial funding set aside for building public and private-sector partnerships. To enhance opportunities for technology commercialization, OST seeks partnerships with private-sector companies during the technology development and demonstration phases. Industry partners will facilitate

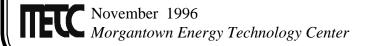
implementing these emerging technologies to solve the nation's environmental problems.

As technology development matures, decisions for the continuation of OST RDDT&E projects are based on technologyinvestment decision methodology. This incorporates seven stages of technology maturation, from basic research through implementation and corresponding decision points (or "gates") at which projects are selected for funding. At each gate, projects are evaluated against technical, regulatory, economic, and institutional criteria to assure that the end products will provide superior performance and meet the acceptance requirements of the customers in the DOE user community. Figure 1 shows the seven stages of technology maturation and the corresponding gates.

Tools employed to select and implement RDDT&E projects include: Program Research and Development Announcements (PRDAs), Research Opportunity Announcements (ROAs), Cooperative Research and Development Agreements, Financial Assistance Awards, Interagency

Figure 1 - Technology Maturation Stages and Gates

| | Basic Research | Applied Research | Exploratory Development | Advanced Development | Engineering Development | Demonstration | Implementation |
|------------------------------------|-------------------|---------------------|--|--|--|-----------------------|-------------------------------|
| Technology Maturation Stages | Idea Ge | neration Need | Proof of T Product definition | echnology Working model | Engineering Prototype | Production Prototype | Utilization by end-user |
| | | | · Non-specific applications | · Reduction to practice | Scaled-up version to test design features and performance limits | · End-user validation | |
| | | | · Bench-scale | · Specific applications · Bench-scale | · Pilot-scale · Field testing | - "Beta" site testing | |
| Gate Expectations | <į | ·> < | | •> < | | ~ | 6 |
| | | DOE | need advant avai techr iledge | age over requir lable nology Demonstr | ements re: | ady de | d-user ploys mology |







TECHNOLOGY DEVELOPMENT THROUGH INDUSTRIAL PARTNERSHIPS

INTRODUCTION

Agreements, and DOE National Laboratory Technical Task Plans. Of these various tools, the PRDAs and ROAs are administered for OST through the Morgantown Energy Technology Center (METC).

Morgantown Energy Technology Center

METC, located in Morgantown, West Virginia, is a program implementation office that supports the DOE Offices of Fossil Energy, Environmental Management, and Energy Efficiency. METC, using the full R&D resource base of the country (industry, universities, national laboratories, and other research entities), carries out a function with a national scope analogous to those of the combined DOE field offices and National Laboratories.

METC is a government-owned and operated entity with Federal personnel having full delegated procurement authority to enter into contracts and assistance agreements on behalf of DOE, including the negotiation of patent and data rights which are important elements in many of the cost-shared R&D agreements that are the heart of the Fossil Energy Program.

Complementing this procurement function is METC's project management function for projects selected under the PRDAs and ROAs. The 85 projects presented in this document are managed by METC's technical staff of scientists and engineers.

Each project is phased, with go/no-go decisions keyed to the OST RDDT&E gates. Accordingly, most projects have a base contract period followed by option periods correlating to process scale-up and demonstration decisions.

To facilitate effective RDDT&E, the OST projects managed by METC are industrial entities that can commercialize new products. The industrial partners use government funding to conduct RDDT&E, enabling them to achieve earlier market entry than would be possible under company-funded only development.

To date, METC has conducted five major solicitations -- two PRDAs, which solicit proposals for specific areas of need, and three ROAs, which solicit proposals in more broad areas of need. METC procurement and technical personnel work directly with the individual focus and crosscutting areas to define needs, select solicitation mechanisms, conduct peer-review of proposals, and select projects for award. METC has solicited two PRDAs for EM. The first, in the area of groundwater and fossil technologies, resulted in twenty-one contract awards to private sector and university technology developers. The second PRDA solicited novel decontamination and decommissioning technologies and resulted in sixteen contract

METC has solicited three ROAs for EM: ROA-I in March 1993, ROA-II in April

1994, and ROA-III issued on April 30, 1996. The ROAs, which are open for one year, solicit research in a broad range of EM-related topics, including in-situ remediation; characterization, sensors, and monitoring technologies; efficient separations technologies; mixed waste treatment technologies; and robotics.

Of the projects selected under the PRDAs and ROAs, a substantial portion have gone to small business technology developers. These Technology Development Data Sheets describe the technology development projects being conducted for OST under the METC-sponsored/administered PRDAs and ROAs.

The Technology Development Data Sheets in this package are organized (and tabbed) by Focus Area:

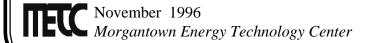
- Mixed Waste
- High Level Waste Tank Remediation
- Subsurface Contaminants
- Decontamination and Decommissioning

These Technology Development Data Sheets can also be found on the METC Homepage along with other important information on the METC Programs. URL: www.metc.doe.gov/research/ewm.html

For more information on EM activities supported by the Morgantown Energy Technology Center, please contact:

Robert C. Bedick
Environmental Management Product Manager
Morgantown Energy Technology Center
(304) 285-4505
Internet: rbedic@metc.doe.gov

Floyd W. Crouse
Environmental and Waste Management Division Director
Morgantown Energy Technology Center
(304) 285-4535
Internet: fcrous@metc.doe.gov







TECHNOLOGY DEVELOPMENT THROUGH INDUSTRIAL PARTNERSHIPS

TABLE OF CONTENTS

Contractor Project Title Page

MIXED WASTE FOCUS AREA



| Aerojet General Corporation | Platelet-Cooled Plasma Arc Torch 1 |
|--------------------------------|---|
| Bio-Imaging Research, Inc. | Waste Inspection Tomography (WIT) |
| Bio-Imaging Research, Inc. | Non-Destructive Examination and Assay of |
| | Drums Containing Transuranic Waste |
| Delphi Research, Inc. | Development Studies for a Novel Wet Oxidation |
| • | Process |
| Eichrom Industry | Novel Silica-Based Ion-Exchange Resin 9 |
| Laser Diagnostics | A Continuous Emission Monitor for Toxic |
| | Metals in the Off-Gases of Thermal Treatment |
| | Facilities |
| Lockheed Martin | Intelligent Mobile Sensor System (IMSS) For Autonomous 13 |
| | Monitoring & Inspection |
| Lockheed Martin | Automated Baseline Change Detection (ABCD) |
| Membrane Technology | Membrane System for Recovery of Volatile |
| Research, Inc. | Organic Compounds from Remediation Off-Gases |
| Mercury Recovery Services | Removal and Recovery of Mercury from Mixed |
| , , | Wastes |
| Mirage Systems, Inc. | Mixed Waste Treatment Using the ChemChar Thermolytic 21 |
| | Detoxification Technique |
| Molten Metals Technology, Inc. | Catalytic Extraction Processing of Contaminated |
| | Scrap Metal |
| Rust Federal Services, Inc. | VAC*TRAX - Mobile Vacuum/Thermal Treatment |
| | System |
| Rust Federal Services, Inc. | Nitrate to Ammonia and Ceramic (NAC) Bench Scale |
| | Stabilization Studies |
| South Carolina Universities | An Intelligent Inspection and Survey Robot |
| Research and Education | • |
| Foundation | |
| Thermochem, Inc. | Steam Reforming of Low-Level Mixed Waste |
| Vortec Corporation | Research and Development of an Innovative Fossil |
| • | Fuel Fired Vitrification Technology |

iii

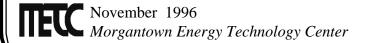




TECHNOLOGY DEVELOPMENT THROUGH INDUSTRIAL **PARTNERSHIPS**

TABLE OF CONTENTS

| Contractor | Project Title P | age |
|---|---|-----|
| WASTREN, Inc. | Evaluation of Electrodialysis - Ion Exchange for the Separation of Dissolved Salts | 35 |
| | TANKS FOCUS AREA | Ĩ |
| EIC Laboratories | Field Raman Spectrograph for Environmental | 37 |
| LSR Technologies, Inc. | Liquid Membrane System for Removal and | 39 |
| Oceaneering Space Systems, Inc. | Robotic End Effector for Inspection of Storage | 41 |
| Science&Engineering | Automated Monitoring System for Fluid Level and | 43 |
| Associates, Inc. Westinghouse Science and | Density in High-Level Waste Tanks An Advanced, Open-Path Atmospheric Pollution | 45 |
| Technology | Monitor for Large Areas | 73 |
| SUBSU | URFACE CONTAMINANT FOCUS AREA | 1 |
| Amerasia | Field Portable Detection of VOCs Using a SAW/GC System | 47 |
| Applied Research Associates | | 49 |
| Applied Research Associates | Tomographic Site Characterization Using CPT, ERT and GPR | 51 |
| ARCTECH, Inc. | Development of Humasorb TM , A Lignite Derived | 53 |
| Atomic Energy of Canada, Inc. | <u> </u> | 55 |
| Babcock & Wilcox, Inc. | · | 57 |
| Babcock & Wilcox, Inc. | In Situ Tritium Beta Detector | 59 |







TECHNOLOGY DEVELOPMENT THROUGH INDUSTRIAL **PARTNERSHIPS**

TABLE OF CONTENTS

| Contractor | Project Title | Page |
|----------------------------------|--|------|
| Coleman Research | Geophysical Data Fusion for Subsurface Imaging | 61 |
| Corporation | | |
| Engineering Computer | Road Transportable Analytical Laboratory (RTAL) | 63 |
| Optecnomics | | |
| Environmental Research | Imaging Data for Hazardous Waste Applications | 65 |
| Institute of Michigan | | |
| General Electric Corporate R & D | Organic Sponges for Cost Effective CVOC | 67 |
| Center | Abatement | |
| Geophex, Ltd. | Geophex Airborne Unmanned Survey System | 69 |
| Halliburton NUS | Soil Saw Demonstration | 71 |
| Intera, Inc. | In-Situ Decontamination of Aquifers by Surfactant | |
| | Solubilization of DNAPL's | |
| K&M Engineering & | Circulating Air Barrier (CAB) System | 75 |
| Consulting Corp. | | |
| Microsensor Systems | Miniature GC for In-Situ Monitoring of Volatile | 77 |
| | Organic Compounds Within a Cone Penetrometer | |
| Mirage Systems, Inc. | Three Dimensional Sub-Surface Imaging Synthetic | 79 |
| Monsanto Co. | Development of an Integrated In-Situ Remediation | Q 1 |
| Wonsanto Co. | Technology | 01 |
| New Mexico Institute of | Surface Altered Zeolytes as a Permeable Barrier | 83 |
| Mining & Technology | Surface Affered Zeofytes as a Termeable Darrier | 05 |
| Physical Optics Corporation | Integrated Optics Chemical Sensor for Simultaneous | 85 |
| Thysical Optics Corporation | Detection & Quantification of Multiple Ions | 05 |
| Science & Engineering | Barometric Pumping with a Twist | 87 |
| Associates, Inc. | Zuromouro z umpring main u z mao v v v v v v v v v v v v v v v v v v v | |
| Science & Engineering | Fiber Optic/Cone Penetrometer System for | 89 |
| Associates, Inc. | Subsurface Heavy Metals Detection | |
| Science & Engineering | In Situ Permeability Measurements | 91 |
| Associates, Inc. | with Direct Push Techniques | |
| Science & Engineering | Subsurface Barrier Validation with the SEAtrace TM | 93 |
| Associates, Inc. | Monitoring System | |
| South Carolina Universities | Management of Municipal Solid Waste Technology | 95 |
| Research and Education | RD&D ("Waste Technology Center") | |
| Foundation | | |





TECHNOLOGY DEVELOPMENT THROUGH INDUSTRIAL PARTNERSHIPS

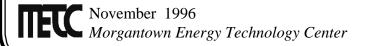
TABLE OF CONTENTS

| Contractor | Project Title | Page |
|-----------------------------|---|-------|
| South Carolina Universities | Measurement of Radionuclides Using Ion | 97 |
| Research and Education | Chromatography and Flow-Cell Scintillation | |
| Foundation | Counting | |
| Stevens Institute of | Stabilization and Reuse of Heavy Metal | 99 |
| Technology | Contaminated Soil by Means of Quicklime-Sulfate | |
| Thermo Power Corp. (Tecogen | Development of an On-Line, Real-Time Alpha | . 101 |
| Division) | Radiation Measuring Instrument for Liquid | |
| Transducer Research, Inc. | Field-Usable Portable Analyzer for Chlorinated | . 103 |
| | Organic Compounds | |
| University of Arizona | High-Resolution Subsurface Imaging & Neural | . 105 |
| • | Network Recognition | |
| University of Vermont | Alcohol Flushing for Removing DNAPLs from Clay | . 107 |
| | and Sand Layered Aquifer Systems | |
| UTD, Inc. | Innovative Directional and Position Specific | . 109 |
| | Sampling Technique | |
| UTD, Inc. | A Steerable Distance Enhanced Penetrometer | . 111 |
| | Delivery System | |
| Weiss Associates | Acoustically Enhanced Remediation of | . 113 |
| | Contaminated Soil and Groundwater | |

DECONTAMINATION AND DECOMMISSIONING FOCUS AREA



| Arrey Industries | Phoenix |
|----------------------------|---|
| Babcock & Wilcox, Inc. | Decontamination of Process Equipment Using 117 |
| | Recyclable Chelating Solvent |
| Carnegie Mellon University | Mobile Worksystem for Decontamination & |
| - | Decommissioning |
| Carnegie Mellon University | Asbestos Pipe-Insulation Removal System |
| Carnegie Mellon University | Operator Interface for Robotic Applications |
| Coleman Research | Three Dimensional Integrated Characterization and |
| Corporation | Archiving System (3D-ICAS) |
| Coleman Research | Coherent Laser Vision System (CLVS) |
| Corporation | |







TECHNOLOGY DEVELOPMENT THROUGH INDUSTRIAL PARTNERSHIPS

TABLE OF CONTENTS

| Contractor | Project Title | Page |
|----------------------------------|--|-------|
| Department of the Army | Task Order - Chicago Pile 5 Decommissioning Project | . 129 |
| Dow Environmental, Inc. | Decontamination and Recycle of Concrete | . 131 |
| F2 Associates | Laser Surface Cleaning | |
| General Electric Corporate R & D | Rapid Surface Sampling and Archive Record | |
| Center | (RSSAR) System | |
| International Union of Operating | Human Factors Assessment of Environmental | . 137 |
| Engineers | Technology | |
| ISOTRON® Corporation | Electrokinetic Decontamination of Concrete | . 139 |
| KAI Technologies | Electromagnetic Mixed-Waste Processing System | |
| C | for Asbestos Decontamination | |
| Lockheed Martin | Multisensor Inspection & Characterization Robot for | . 143 |
| | Small Pipes (MICROSPI) | |
| Manufacturing Sciences | Advanced Technologies for Decontamination and | . 145 |
| Corporation | Conversion of Scrap Metal | |
| Mechanical Technology, Inc. | Interactive Computer-Enhanced Remote Viewing | . 147 |
| 2, | System | |
| Mechanical Technology, Inc. | Diagnostics And Data Fusion of Robotic Sensors | . 149 |
| Membrane Technology & | Protective Clothing Based on Permselective | |
| Research Inc. | Membrane and Carbon Adsorption | |
| NeuTek | High-Sensitivity Monitor for Radionuclides | . 153 |
| Oceaneering Space Systems, Inc. | Advanced Worker Protection System (AWPS) | . 155 |
| Oceaneering Technologies, Inc. | Remote Operated Vehicle Dry Ice Pellet | |
| | Decontamination System | |
| Physical Sciences, Inc. | Portable Sensor for Hazardous Waste | . 159 |
| Redzone Robotics, Inc. | Houdini: Reconfigurable In-Tank Robot | . 161 |
| Science & Engineering | Characterization of Radioactive Contamination | |
| Associates, Inc. | Inside Pipes with the Pipe Explorer TM System | |
| SRI International | Novel Mass Spectrometric Instrument for Gaseous and | . 165 |
| | Particulate Characterization | |
| Textron Defense Systems, Inc. | Concrete Decontamination by Electro-Hydraulic | . 167 |
| - | Scabbling | |
| Westinghouse Electric | Treatability Study Using Prompt Gamma Neutron | . 169 |
| Corporation | Activation Analysis (PGNAA) Technology | |

vii

